UCLouvain

lelec2900

2021

Signal processing

5.00 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Jacques Laurent ;Vandendorpe Luc ;
Language :	English
Place of the course	Louvain-la-Neuve
Learning outcomes	**At the end of this learning unit, the student is able to :** At the end of this learning unit, the student is able to : • With respect to the AA referring system defined for the Master in Electrical Engineering, the course contributes to the development, mastery and assessment of the following skills : AA1.1, AA1.2, AA1.3 1 AA2.1, AA2.2 AA6.1 The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled “Programmes/courses offering this Teaching Unit”.
Evaluation methods	• Concerning the lectures, the students are individually evaluated with a written exam, including problems solving, and questions on the theory. • For the numerical exercises on Python, the students are evaluated in computer room (in-session or out-of-session).
Teaching methods	14 lectures 12 training sessions
Content	• Sampling: theorem, interpolation, sequence • Sampling rate change: downsampling and interpolation for low-pass signals and bandpass signals, complex envelope • Processing structures and graph theory: switching, transposition, direct and polyphase structures • Discrete Fourier transform, properties, convolution, truncation and window • Finite impulse response filters, phase linearity, types and properties of poles and zeros • Synthesis of FIR filters: window method, frequency response sampling, minimax synthesis and Remez method • Synthesis of IIR filters: Prony method, synthesis method by bilinear transformation • Comparison of the IIR and FIR filters: discussion on the linear phase and the complexity • Non-parametric spectral analysis by the discrete Fourier transform: compromise between the resolution and the level of the secondary lobes • Fast Fourier Transform (FFT) algorithm • Parametric spectral analysis: identification of a auto regressive model - Yule-Walker equation and Levinson-Durbin algorithm • Adapted and adaptive filtering. • Theory of multiresolution and wavelet transforms: links between sampling and projection on a vector space generated by orthonormal basic functions of index type. Examplification by the Haar Transform. • Compressive sensing. • Exercises on the use of Python for the prototyping of signal processing systems
Inline resources	Moodle https://moodle.uclouvain.be/course/view.php?id=715
Bibliography	• Course and lecture notes available on Moodle • Slides and reference articles available on Moodle First half of the course available as a podcast
Faculty or entity in charge	ELEC

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Electrical Engineering	ELEC2M	5		
Master [120] in Biomedical Engineering	GBIO2M	5		
Master [120] in Mathematical Engineering	MAP2M	5		